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# AI-Driven Efficiency: Large Language Models in Business Process Optimization

## Diploma Presentation

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# Motivation

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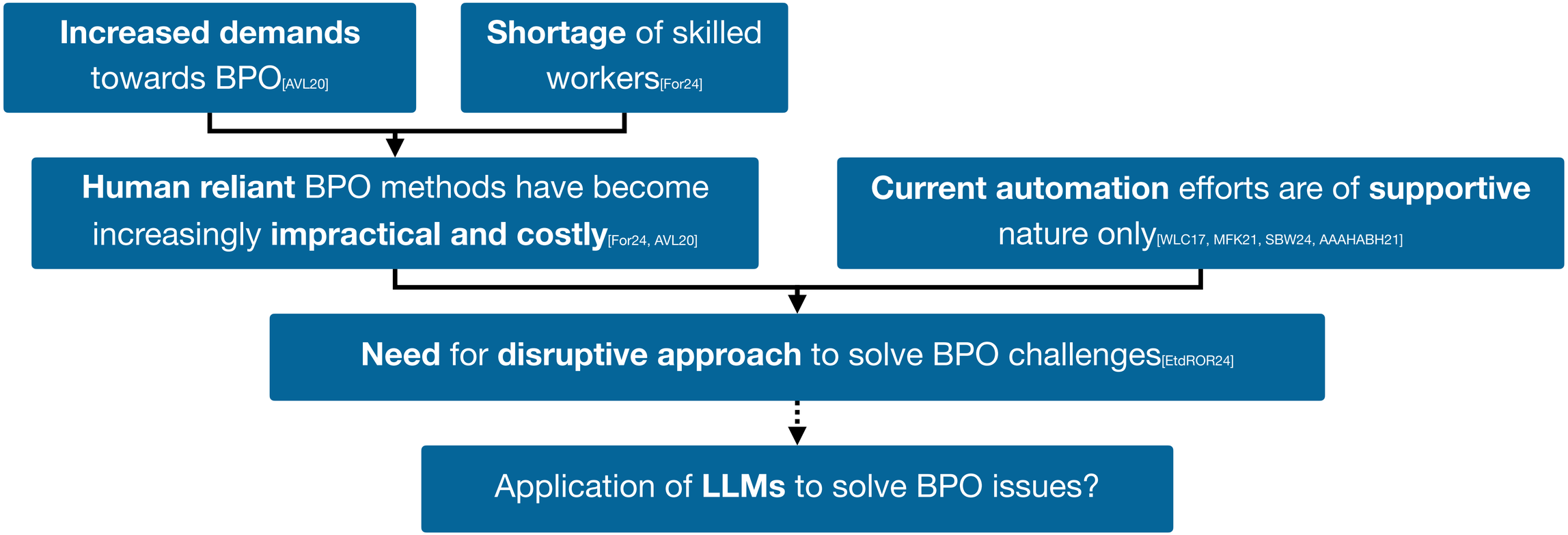
# Digitization of Business Process Optimization (BPO)

**An ongoing development**



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# Problem Statement

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“little research so far on the **capabilities** of LLMs for BPO … question if **LLMs** are able to automate **BPO-tasks** has not been answered in a **scientific manner**”

**excerpt from the Thesis**

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# Research Questions

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## Overarching Research Question

### ORQ

To what extent do **current state-of-the-art** Large Language Models **align** with **established standards** when **performing business process optimization** tasks?

## Specific Research Question

### SRQ1

To what extent does increased **contextual information** impact the alignment of the LLM to established standards?

### SRQ2

To what extent do **task complexity and interdependencies** impact the alignment of the LLM to established standards?

### SRQ3

To what extent does the **quality of the initial process** impact the alignment of the LLM to established standards?

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# Approach

# “*Action Research-Based Compliance Testing*”

## Compliance Testing in an Action Research Framework

**Action Research**[Bas99]

… for deepening understanding of capabilities through multiple cycles

*5 Cycles*

*4 Processes*

**Repeated Structured Experiments**[DAB22]

Multiple reruns in controlled environment to counteract model randomness

*5 Repetitions*

**Compliance Testing**[YRD10]

Assess abilities of the model against established scientific standards

2 Standards: *7PMG*[7pmg10] & *Redesign Heuristics*[Red05]

**Error Injection**[AAA90]

Inject violations of established standards into optimized process to evaluate model capabilities

*5 Guidelines per Standard*

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# Guideline Violations

## How we guide the LLM towards performing BPO

Cycle 1 (Context-Minimal)

Cycle 2 (Context-Enhanced)

Cycle 3
PDF → BITMAP

Cycle 4 (Context-Minimal)

Cycle 5 (Context-Enhanced)

### Evaluation of Process Modeling Capabilities

*7PMG*

| | Analysis Process |
|---|---|
| G1: *Use as Few Elements as Possible* | ✓ |
| G2: *Minimize the Routing Paths per Element* | ✓ |
| G3: *Use One Start and One End Event* | ✓ |
| G4: *Model as Structures as Possible* | ✓ |
| G5: *Use Verb-Object Activity Labels* | ✓ |

### Evaluation of Process Optimization Capabilities

*Redesign Heuristics*

| | Design Process | Implementation Process | Go-Live Process |
|---|---|---|---|
| G1: *Task Elimination* | ✓ | | ✓ |
| G2: *Task Composition* | | ✓ | ✓ |
| G3: *Resequencing* | ✓ | | ✓ |
| G4: *Parallelism* | ✓ | | ✓ |
| G5: *Task Automation* | | ✓ | ✓ |

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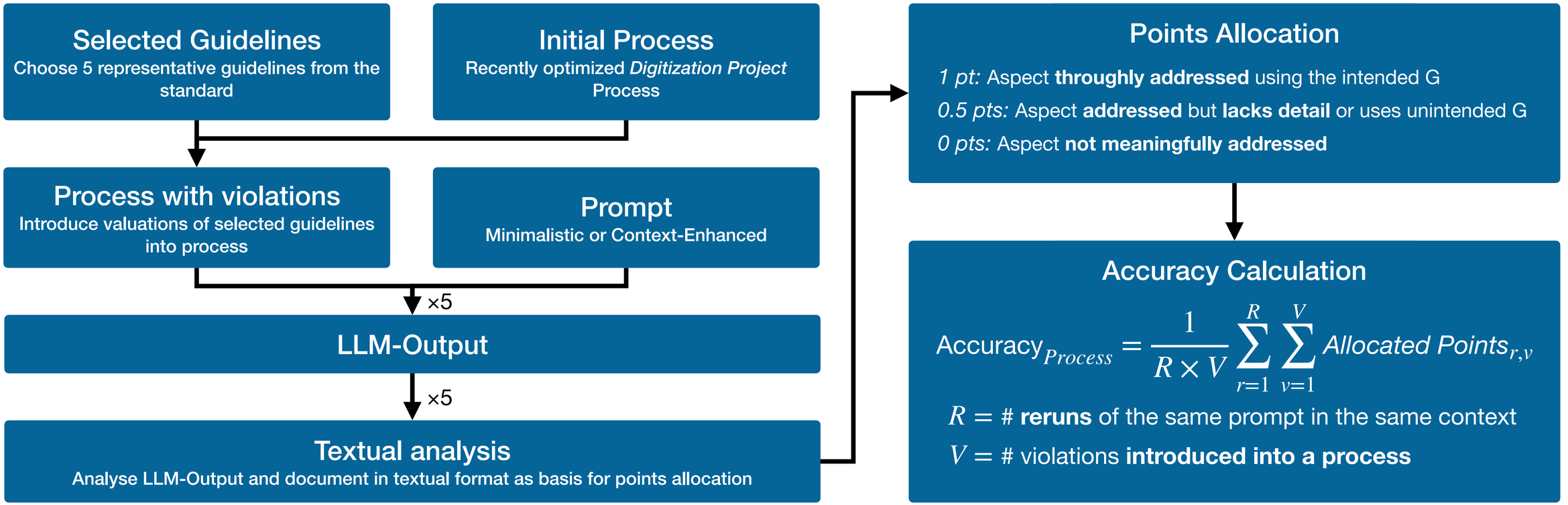
# Application of ARCT Methodology

**Our research process generating scientific insights**



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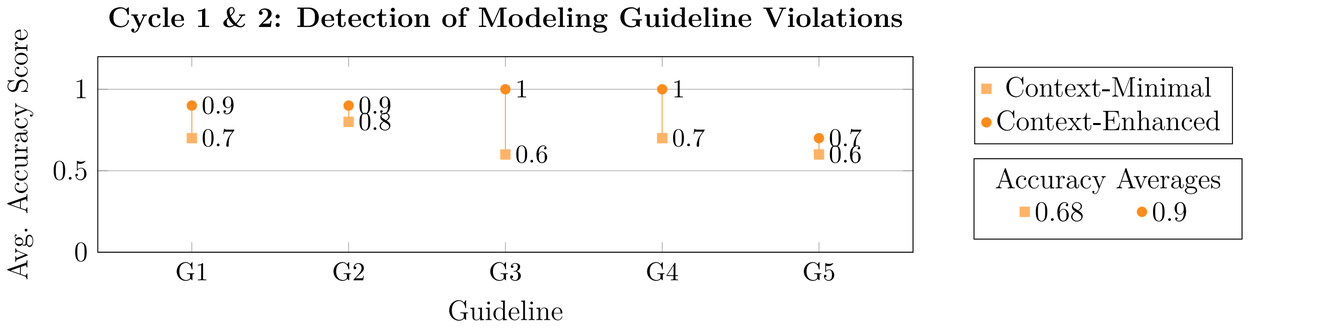
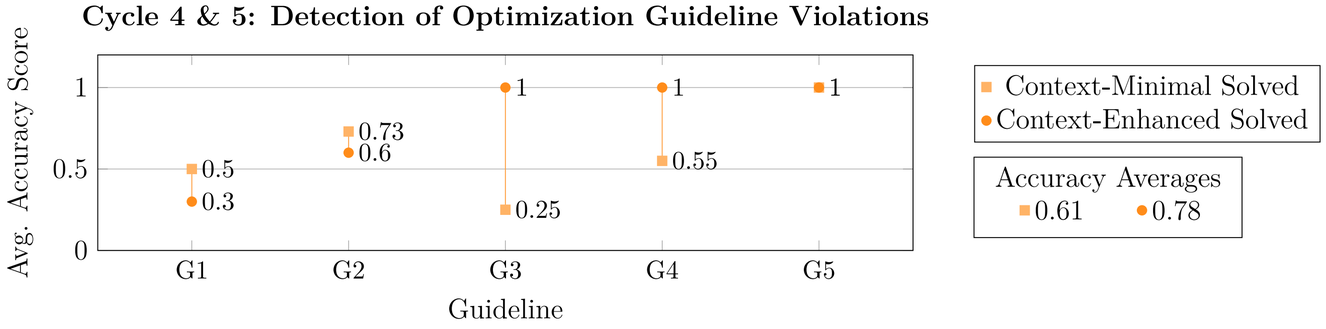
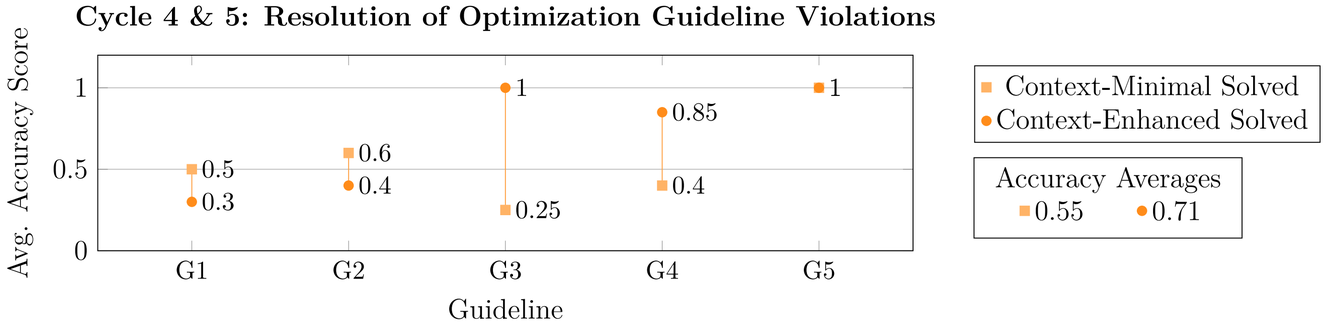
# Key Findings & Answers to RQ's




## SRQ1

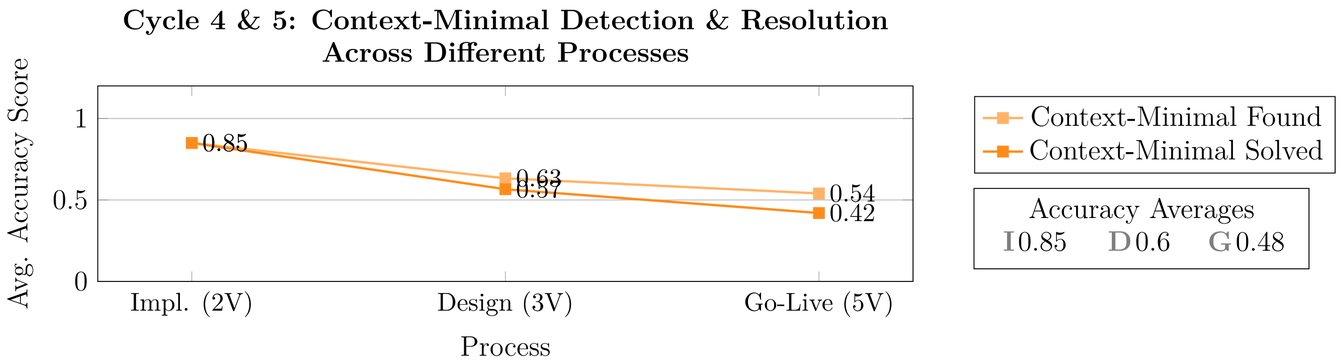
To what extent does increased **contextual information** impact the alignment of the LLM to established standards?

*Significantly **enhances alignment**, but excessive guidance risks **overfitting**.*

## SRQ2

To what extent do **task complexity and interdependencies** impact the alignment of the LLM to established standards?

*Depth-of-understanding of process steps and their interdependencies required by optimization approaches (e.g., elimination vs. resequencing) significantly **impacts alignment***




## SRQ3

To what extent does the **quality of the initial process** impact the alignment of the LLM to established standards?

*Numbers of violations **impacts alignment**, **baseline** of reliability is however **maintained**, even in highly unoptimized processes.*

## ORQ

To what extent do **current state-of-the-art** Large Language Models **align** with **established standards** when **performing business process optimization** tasks?

*Current LLMs **partially align** with established BPO standards, but **require careful guidance** and oversight for complex cases.*

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# Conclusions

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# Future Research Directions

**Questions That Emerged During Our Research**

| | |
|---|---|
| **Impact of Prompt Engineering** | How can **prompts** be designed to optimize LLM responses without overfitting, balancing guidance with model autonomy? |
| **Impact of Model advancements** | How will **advancements in models** like GPT-o1 impact the capabilities of LLMs for BPO? |
| **ARCT-Refinement** | How could the Action Research-Based Compliance Testing (**ARCT**) be further refined for getting deeper insights? |

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# Contributions

## The Dual Impact of Our Work

**Methodological Contribution**

Established Action Research-Based Compliance Testing (**ARCT**) Methodology for LLM-capability assessment

**Practical Contribution**

Results show that LLMs are **capable of partially automating BPO**; through tailored approaches and model advancements a **higher degree of automation** can be **expected**